Remarks/Arguments:

Claims 1-15, 17, 19-22, 24-29, 31-36, 39, 116, 121, and 122 are pending in this case. Claims 1, 9,10, 11, 12, 13, 14, 15, 17, 24, 27, 31, 36, 39 and 121 have been currently amended, a new multiple dependent claim 122 has been added and new dependent claims 123-128 have been added. Claims 8, 16, 18, 23, 30, 37, 38, 40-115, and 117-120 have been cancelled.

Applicants have amended independent claim 1 to recite that an ozone-solvent solution is passed through a heater to form a heated ozone-solvent solution that is supersaturated with ozone. That supersaturated heated ozone-solvent solution is then reacted with the material at an elevated temperature. Claim 31 has been similarly amended.

This process described in claim 1 as it has been amended is actually quite different from that disclosed in the principal reference, Ogisu et al. Ogisu clearly is providing an equilibrium process, which does not result in the formation of a supersaturated solution! This is can be seen by referring to Column 15 lines 24-35, where Ogisu notes that Fig. 3 therein shows the relationship between temperature of water and solubility coefficient of ozone (at equilibrium). And I quote:

> "As is seen, the higher the temperature, the lower the solubility of zone. In addition, ozone becomes readier to be decomposed with an increase in temperature. On the contrary, it is well known that the rate of reaction (rate of surface modification) increases according as the temperature of water rises. Accordingly, it is desirable that the aqueous ozone solution be heated by heater 9 to a properly decided temperature that is moderately low for keeping the ozone concentration as high as possible and at the same time, moderately high to assuring a satisfactory reaction rate."
> (This concept is also presented at Column 6, lines 7-18, and again in Column 10, line 66 through Column 11, lines 1-10)

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Clearly, Ogisu's solution to the problem is to choose a temperature that is a compromise between a low temperature that is suitable for achieving a high dissolved ozone concentration as predicted by Henry's law (see Figure 3), and a high temperature that is suitable for achieving a high reaction rate. Ogisu fails to recognize that this compromise is only required under equilibrium conditions. Ogisu does not teach nor does he disclose a method or apparatus for forming an ozone solvent solution with a higher concentration at a particular temperature than would be predicted by Henry's law. In contrast, the applicant's disclose a method and apparatus for achieving a higher dissolved ozone concentration at a given temperature than would be predicted by Henry's Law. The applicants' method is based upon forming a supersaturated heated ozone-solvent solution.

In Fig. 12 Ogisu shows a conventional immersion system where his ozone generator provides ozone directly to a large open vessel 54 that has a heater 55 in it for heating the ozone-water solution in the vessel 54. In the open vessel configuration, he measures a concentration of ozone of 4ppm (From TABLE 1). To get a higher concentration of ozone, he solves the problem by moving the ozone generator in Fig. 12 out of the open vessel and locates it in line at a point just upstream of the heater. (See Fig. 7(a) Given this location of the ozone generator, it is not surprising that the ozone concentration is higher, just upstream of the application means as reported, than the concentration in the large open vessel. (6ppm at the workpiece versus 4ppm according to TABLE 1) The small 2 ppm difference in the ozone concentration measured in the two systems cannot be attributed to the method of heating of the ozone solvent solution. One skilled in the art would expect that the concentration of the ozone solvent solution at the heater outlet would be higher than that of the ozone solvent solution inside the large open vessel 54 in Fig. 12 because the ozone is being lost from solution by diffusion to ambient from the large surface of ozonated water in vessel 54 that is exposed to the room ambient. This approach of Ogisu does not have anything to do with supersaturating the ozone-solvent solution. Furthermore, Ogisu's substantive teaching is directed to the different means of applying an ozone-water

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solution to a material with spray nozzles and the like to achieve better surface treatment for improved paint adhesion and his claims are focused on that invention.

Ogisu does not teach a method for, nor does Ogisu dislose an apparatus for, heating an ozone solvent solution to produce a supersaturated heated ozone solvent solution. The time during which the heated ozone solvent solution concentration can fall by decomposition or loss of ozone from solution is determined by the heating time and the transit time from the heater to the point of use. The transit time through the heater is the heater residence time equal to the heater volume divided by the volume flow rate of the solution through the heater. The transit time from the heater outlet to the point of use is determined by the residence time of the heated solution as it passes through the volume of connecting tubing and volume of other elements between the heater and the point of use. This latter transit time is equal to the volume of the tubing and other elements divided by the volume flow rate of the solution through those elements. The rate of fall of the ozone concentration is higher at higher temperatures. Accordingly, an apparatus for heating an ozone solvent solution to form a supersaturated heated ozone solvent must take account of the transit time through the heater and the transit time from the heater outlet to the point of use and the temperature and the influence of temperature on the rate of decay of the concentration. At temperatures of the order of 65 C to 85 C, the rate of decay of the concentration is sufficiently high that the concentration can fall to a very low value if the method and apparatus for heating is not designed with a heater residence time and heater outlet to point of application residence time which is small relative to the decay time of the concentration at that temperature. Clearly, Ogisu has not enabled in any way, an apparatus for creating a supersaturated heated ozone-solvent solution.

Nowhere in the Ogisu reference is there any statement that the concentration of ozone he chooses is ever above the equilibrium concentration as predicted by Henry's law, he simply does not realize that one could get a higher concentration if one formed the ozone solvent solution at a lower temperature and then heated the ozone-

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solvent solution to a higher temperature in such a way as to produce a _supersaturated heated ozone solvent_ , which is the teaching of Applicants' specification.

For these reasons, Applicants respectfully request reconsideration of the pending claims in view of these amendments, and believe all claims now pending in this Application are free of the prior art and are in condition for allowance. The issuance of a formal Notice of Allowance for the present application at an early date is respectfully requested.

If any time extensions are required, such time extensions are hereby requested, and if any fees are required in addition to the check provided herewith, please take those fees from deposit account 10-1218.

Respectfully submitted,
DAVID G. BOYERS

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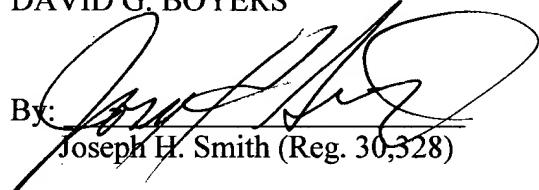
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